Table 2: Invertebrate and plant taxa observed along AT&T's proposed AAG S-5 fiber optic cable route offshore Morro Bay, California

Phylum	Scientific Name	Common Name	Habitat[1]		
			HB	MB	SB
Angiosperm		**Flowering Plant**			
	Phyllospadix sp.	Surf grass	x		
Chlorophyta		**Green Algae**			
	Ulva spp. drift	Sea lettuce, drift	x		
Phaeophyta		**Brown Algae**			
	Egregia meanzinii drift	Feather boa kelp drift	x	x	x
	Macrocystis pyrifera drift	Giant kelp, drift	x	x	x
	Nereocystis californica drift	Bull kelp, drift	x	x	x
Rhodophyta		**Red Algae**			
	Callophyllus sp.	Beautiful leaf algae	x		
	Corallincea Unident., drift	Coralline algae, drift	x	x	x
	Rhodymenia sp.	Red membrane algae	x		
Porifera		**Sponges**			
	Polymastia pachymastia	aggravated vase sponge	x		
	Spheciospongia confoederata	Grey moon sponge	x		
		Sponge, foliose white	x	x	
		Sponge, large white	x		
		Sponge, white	x	x	
		Sponge, white encrusting	x	x	
		Sponge, white/gray saucer	x	x	
		Sponge, grey	x	x	
		Sponge, orange	x		
		Sponge, salmon encrusting	x	x	
		Sponge, tan bulbous	x		
		Sponge, tan globose	x		
		Sponge, yellow	x	x	
	Tethya aurantia	Orange puff ball sponge	x	x	
	Toxadocia spp.	White finger sponge	x		
Cnidaria		**Hydroids, Sea Anemones, Sea Pens, Corals**			
	Acanthoptilum sp.	Sea Pen		x	x
	Adelogorgia phyllostera	Orange gorgonian	x		x
	Anthopleura artemsia?	Moonglow anemone			x
	Aurellia sp.	Moon jelly			
	Balanophyllia elegans	Orange cup coral	x		
	Caryophillia sp.?	White cup coral	x		
	Cerianthidae, unident.	Cerianthid anemone		x	x
	Corynactis californica	Strawberry or club-tipped anemone	x		
	Lophelia sp.	Branching white coral	x		

Phylum	Scientific Name	Common Name	Habitat[1]		
			HB	MB	SB
	Lophogorgia chiliensis	Red gorgonian (sea whip)	x		
	Metridium farcimen (=giganteum)	White-plumed anemone	x	x	x
	Paracyathus stearnsi	Brown cup coral	x	x	
	Pachycerianthus sp.	Tube anemone	x	x	
	Ptilosarcus gurneyi	Orange or fleshy sea pen			x
	Scytalium sp.	Sea pen		x	x
	Stomphia coccinea	Swimming anemone	x		x
	Stylaster californicus (formerly Allopora californica)	California hydrocoral	x		x
	Stylatula elongata	White sea pen		x	x
	Stylatula sp.	Sea pen		x	x
	Urticina piscivora	Rose anemone	x	x	
	Urticina sp.	Anemone, unident.			x
	Virgularia californica	Sea pen			x
	Virgularia sp	Sea pen		x	x
	Virgularidae unident.	Sea pen		x	x
	Urticina columbiana	Sand-rose anemone	x	x	
	Urticina piscivora	White-spotted rose anemone Fish-eating anemone	x		
	Urticina sp.	Sand dwelling anemone			x
		Plumed hydroid, unident.	x		x
		Branched hydroid, unident.	x		
Annelida		**Segmented Worms**			
	Amphinomidae	Polychaete worm			x
	Chloeia pinnata ?	Free living polycahete			x
	Diopatra ornata	Ornate tube worm			x
		Serpulid worm casing	x		
		Tube Worm, unident.			x
Mollusca		**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**			
	Anisodoris sp.	Yellow nudibranch	x		
	Astrea gibberosa	Red turban snail	x		
	Bivalve Mollusk	Clam like bivalve			
	Calliostoma annulatum	Purple-ring top snail	x		
	Chromadorid sp.	Chromid sea slug	x		
	Flabellinopsis iodinea	Spanish shawl nudibranch	x		
	Gastropoda	Marine snail			
	Loligo sp.	squid		Water	
	Nudibranch, dorid white	Sea slug	x		

Phylum	Scientific Name	Common Name	Habitat[1]		
			HB	MB	SB
	Octopus rubescens	Octopus			x
	Pleurobranchea californica	Sea slug			x
Arthropoda		**Shrimp, Crabs, Isopods**			
	Cancer gracilis	Slender crab		x	x
	Cancer sp	Crab	x	x	x
	Hinnites giganteus	Rock scallop	x		
	Loxorhynchus crispatus	Masking crab	x		
	Munida quadrispina	Squat lobster	x		
	Paguristes sp.	Hermit crab		x	x
	Pandalus danae	Coon stripe shrimp	x		
	Pandalis jordani ?	Pacific ocean shrimp	x	x	x
	Pandalid shrimp	Shrimp	x	x	x
Ectoprocta		**Bryozoans**			
		Bryozoa, tan Bryozoa, tan branching Bryozoa, white branching Bryozoa, white branching Bryozoa, pink encrusting Bryozoa, orange encrusting Bryozoa, orange branching	x		
	Membranipora sp.	White encrusting bryozoan on drift kelp		x	
		White ectoproct?			
	Cellaria sp	Stick-figure bryozoan	x		
Echinodermata		**Sea Stars, Brittle Stars**			
	Amphiodia sp.	Brittle star			x
	Amphipholis sp.	Brittle star			x
	Asterina miniata	Bat star			x
	Astropecten verrilli and/or A. *armatus*	Spiny sand star			x
	Ceramaster patagonicus	Cookie cutter sea star	x		
	Dedraster ecentricus	Sand dollar		x	
	Dermasterias imbricata	Leather star	x		
	Echinoderm, juvenile unident.	Juvenile sea star	x		
	Florometra serratissima	Crinoid	x		
	Henricia spp.	Sea star	x		
	Mediaster aequalis	Red sea star	x		
	Ophiocantha diplasia	Brittle star			x
	Ophionereis sp.	Brittle star			x
	Ophiura sp.	Brittle star		x	x
	Ophiuroids	Brittle star		x	x

Phylum	Scientific Name	Common Name	Habitat[1]		
			HB	MB	SB
	Orthasterias koehleri	Rainbow sea star	x		
	Parastichopus sp.	Sea cucumber			x
	Petalaster (luidia) foliolata	Leafy flat star			x
	Pisaster brevispinus	Pink sea star	x	x	x
	Pisaster sp.	Sea star	x	x	x
	Pisaster giganteus	Giant-spined sea star	x		
	Pteraster tesselatus arcuatus	Fat sea star			x
	Pycnopodia helianthoides	Sunflower star			x
	Rathbunaster californica	Multi-armed sea star			x
	Solaster dawsonii	Morning sun star			x
Urorchordata		**Tunicates**			
	Archidistoma psammion	Compound ascidian	x		
	Ascidia paratropa	Glassy tunicate	x		
	Boltenia villosa	Spiny-headed tunicate	x		
	Cystodytes sp.	Lobed tunicate	x		
	Polyclinum planum	Elephant ear tunicate	x		
	Styela montereyensis	Stalked tunicate	x		

[1] = HB – hard-bottom, MB – mixed-bottom, SB – soft-bottom

Table 2: Fish taxa observed along AT&T's proposed AAG S-5 fiber optic cable route offshore Morro Bay, California

Scientific Name	Common Name	Habitat			
		Hard Bottom	Mixed Bottom	Soft Bottom	Water Column
Agonidae unident.	Poacher		x	x	
Aulorhynchus flavidus	Tubesnout			x	x
Cephaloscyllium ventriosum	Swell shark			x	
Chilara taylori	Spotted cusk-eel			x	
Chilara sp	Cusk-eel			x	
Citharichthys sordidus	Pacific sanddab			x	
Citharichthys spp	Sanddab			x	
Cottidae unident.	Sculpin, cabezon	x	x	x	
Engraulis mordax	Anchovy	x	x	x	x
Enophrys taurina	Bull sculpin		x	x	
Eptatretus stouti	Pacific hagfish			x	
Genyonemus lineatus	White croaker			x	x
Hydrolagus colliei	Spotted ratfish			x	
Lycodes sp.	Eelpout			x	
Microstomus pacificus	Dover sole			x	

Scientific Name	Common Name	Habitat			
		Hard Bottom	Mixed Bottom	Soft Bottom	Water Column
Heterostichus rostratus	Giant Kelpfish	x			
Oxylebius pictus	Painted Greenling	x			
Ophiodon elongatus	Lingcod			x	
Paralichthys californicus	California halibut			x	
Pleuronectes vetulas	English sole			x	
Pleuronectidae unident.	Sole			x	
Raja binoculata	Big skate			x	
Raja rhina	Longnose skate			x	
Raja sp.	Skate			x	
Sebastes serriceps	Tree fish	x			
Sebastes elongatus	Green stripped rockfish	x			
Sebastes semicinctus	Half banded rockfish	x			
Sebastes maliger	Quillback rockfish	x			
Sebastes rosaeeus	Rosy rockfish	x			
Sebastes serrinoides	Olive rockfish	x	x	x	
Sebastes spp. (juveniles)	Rockfish (juveniles)	x	x	x	
Sebastes spp. (adult)	Rockfish (adult)	x		x	
Paralabrax clathratus	Kelp bass	x			
Squatina californica	Pacific angel shark			x	
Symphurus atricauda	California tonguefish			x	
Torpedo californica	Pacific electric ray			x	
Zalembius rosaceus	Pink surfperch	x			
Zaniolepis latipinnus	Longspine combfish			x	
Zapteryx exasperata	Banded guitarfish			x	
	Unidentified fish	x	x	x	x
	Unidentified flattfish	x	x	x	x

4.1 Soft-bottom Habitat

4.1.1 Segments A & B (21.3-32.0m)

These two segments of the initial proposed cable route, and its associated marine habitat and epibenthic community, transits from the borepipe to approximately 32-m (100ft) water depth and predominantly parallels the coastline. The seafloor along this segment appears to be composed of fine to medium sand with some shell hatch. Although the geophysical mapping for this area of the proposed cable route indicated the possible presence of low-relief hard-bottom, none was encountered. Strong surge and high turbidity was observed in this area and the coarse sediments and scoured appearance of the exposed rocks at the north end of Survey Segment B, where Survey Segment C began, suggest the area is subject to heavy surge and sand movement. The final proposed cable route includes realignment to the east through the northern portion of Survey Segment B, in order to avoid the low- and high-relief hard-bottom habitat observed and mapped in Survey Segment C (Figures 3b, 3c). The cable route

realignment in Survey Segment B keeps the cable in the same soft-bottom habitat observed during the ROV Biological Survey (Figures 3b, 3c).

Fourteen alga and invertebrate taxa were observed in the ROV Biological Survey video records from the initial proposed cable route surveyed in Survey Segments A and B (Table 4). The invertebrate epibenthic community included the ornate tube worm (*Diopatra ornata), cancer crabs (Cancer sp.),* the slender crabs *(Cancer gracilis), octopus (Octopus rubescens*), the white sea pen (*Stylatula elongata*), occasional polychaete tube worms, *Pachycerianthus* anemones, and the sea star *Petalster* (*Luidia) foliolata*, The sea stars *Asterina miniata* and *Mediaster aequalis*, were observed when in close proximity to exposed hard substrate at the north end of Survey Segment B. Figure 4 is a representative photograph of the habitat observed in Survey Segments A and B. The invertebrate community was dominated by ornate tubeworms (*D. ornata*) with hundreds of colonies per square meter and highly mobile organisms like octopus and cancer crabs.

Six fish taxa were observed in the video records from the initial proposed cable route surveyed in Survey Segments A and B (Table 5). Observed fish species included cusk-eels (*Chilaria* sp), flatfish, sandabs (*Citharichtys* sp.), a tubesnout (*Aulorhynchus flavidus*), and anchovies (*Engraulis mordax*) in the water column. In addition, squid (*Loligo* sp.) were periodically observed in the water column as well.

It is expected that the biota inhabiting the realigned final proposed cable route in Survey Segments A and B are the same as those observed in the video records from the ROV Biological Survey. The realigned route does not include any habitats, water depths, or physical conditions that were not encountered in the ROV Biological Survey along these cable route Segments.

4.1.2 Segment C (27.40-32.0m)

Survey Segment C consisted predominantly of low- and high-relief hard-bottom habitat with brief segments of shallow depth, soft-bottom, between exposed shelf rock and boulders, along the initial proposed cable route. Similar oceanographic conditions to those observed in Survey Segments A & B were also observed. The soft-bottom areas were inhabited by the same organisms described in Survey Segments A&B, except hard-bottom species that can inhabit soft-bottom areas were also observed, like the sea stars *A. miniata, M. aequalis,* and *Pisaster brevispinus* along with some additional species of rockfish were observed more frequently. Twenty-eight invertebrate taxa and nine fish taxa were observed in video records from the soft-bottom areas of Survey Segment C (Tables 4, 5). Figure 5 is a photograph of some soft-bottom habitat in Survey Segment C adjacent to low-relief hard-bottom habitat.

The final proposed cable route realigns the cable to the east of the initial route (Figures 3b, 3c) through what is interpreted to be predominantly shallow sandy soft-bottom sediments like those observed and characterized in this Section of the proposed cable route. The cable route realignment was made in order to avoid the extensive hard-bottom habitat observed and mapped along the original proposed route. This realignment eliminates cable routing through approximately 386-m of hard-bottom habitat (254-m of LR; 181-m of HR) and transits an estimated 175-m of additional sand bottom and 160-m of mixed-bottom and cobble, based on seafloor mapping and ROV Biological Survey observations. The new routing through Survey Segment C adds an estimated 100-m to the cable route through predominantly soft-bottom habitat. Some low-relief rock or mixed-bottom may be encountered at the southern end of the Segment (Figure 3c). The marine biota in the soft-bottom and habitat in this Survey Segment are expected to be identical to that described for soft-bottom areas in Survey Segments A, B, and C. The epifauna inhabiting mixed-bottom habitat is expected to be identical to the mixed-bottom biota described in Survey Segment D in Section 4.2.1, below.

4.1.3 Segment D (32.0-76.2m)

This Segment of the initial proposed cable route was characterized on the geophysical seafloor maps (Figures 2, 3) as either "mixed-bottom" or "Coarse Sediment (Sand and Gravel)". It trends in an east-west direction and contains a variety of sub-habitats including low- and high-relief hard-bottom, coarse sand and cobble/small rocks, coarse sand and shell hatch soft-substrate and one small stretch of heavily bioturbated finer sand and silt soft-substrate, observed during the ROV Biological Survey. The predominant habitat within this Survey Segment was soft-bottom, composed of coarse sand, pebbles, and shell hatch, occurring in long, steep sand waves, running parallel to shore (north-south) (Figures 3c, 3d). Figure 6 provides an image of the seafloor and these standing coarse-sand waves, taken with the sonar attached to the ROV. Figures 7 and 8 provide photographic images of the sand wave crests and troughs, respectively.

Along a portion of Survey Segment D, within the region of sand waves, an area of flat, highly bioturbated fine sediment seafloor, was also observed (Figure 3d). This stretch of habitat was located at a depth of approximately 200ft, with a clearly defined break between the sand waves and flat mud bottom and ran approximately east-west. Figure 9 illustrates this feature in a sonar image from the ROV. The current geophysical seafloor mapping for this area of the proposed cable route (Figure 3d) indicates that this area of bioturbated soft-bottom is part of a long finger of fine sediment extending from the northwest into the mixed-bottom and coarse-sand habitat mapped during the ROV Biological Survey. This area of flat mud seafloor was just west of an area of low-relief hard-bottom and was similar to the highly bioturbated soft-bottom areas described occurring in Survey Segments E and F. The final proposed cable route through Survey Segment D is realigned in a southwest direction at the western end of the Survey Segment (Figure 3d). This cable route realignment, like the one in Survey Segment C, was made to avoid a concentration of low-and high-relief hard-bottom rock outcropping at the western edge of the Survey Segment (Figure 3d). The new route is expected to predominantly transit the coarse-sand, shell hatch, and pebbles habitat that predominates in this Survey Segment. Some low-relief and cobble hard-bottom habitat will also be encountered along the realigned cable route, but to a much lesser extent than observed along the initial proposed route (Figure 3d).

Forty-three algal and invertebrate taxa were observed in video records from soft-bottom areas along the initial proposed cable route transiting Survey Segment D (Table 4). Observations of organisms in this region of sand waves suggest they exert a strong influence on the distribution of many taxa. Associated invertebrate biota included sea pens, mostly *Stylatula elongata*, *Acanthoptilum sp*., and *Ptilosarcus gurneyi,* brittle stars including *Ophioneries* sp., the cerianthid anemone *Pachycerianthus sp*., the anemones *Urticina piscivorus, Urticina sp*., and Stomphia coccinea, tube worms, cancer crabs including the slender crab (*Cancer gracilis*), shrimp, (*Pandalus sp*.), occasional marine snails (Gastropoda), the California sea slug (*Pleurobranchia californica*), hermit crabs, (*Paguristhes sp*.), and several species of sea stars including *Pisaster brevispinus*, *Petalaster (luidia) foliolata, Rathbunaster californica, Asterina miniata,* and *Solaster dawsonii*. Ornate tube-worms (*Diopatra ornata)* were occasionally observed in the troughs of the sand waves and occasional isolated sand dollars (*Dendraster ecentricus*) were observed on the tops of sand waves. Squid (*Loligo* sp.) were also frequently observed in the water column. The sea pen *P. gurneyi* and the sea star *P. brevispinus* were observed only at water depths of 48.8 m (160 feet) or less. The most abundant invertebrate organisms were sea pens, including *Stylatula elongata*, *Acanthoptilum sp*., and *Ptilosarcus gurneyi,* brittle stars (Ophiuroids), especially *Ophioneries* sp., tube worms, and the sea stars *P. brevispinus, A. miniata,* and *R. californica*.

Table 4: Invertebrate taxa and drift algae observed in association with soft-sediment habitat areas along the six Survey Segments of the AT&T AAG S-5 fiber optic cable route offshore Morro Bay, California.

Scientific Name	Common Name	Cable Route Segment					
		A&B	C	D	E	F (<340ft)	F (> 340ft)
Angiosperm	**Flowering Plant**						
Phyllospadix sp.	Surf grass, drift	P	P	P	P	P	
Phaeophyta	**Brown Algae**						
Egregia meanzinii	Feather boa kelp, drift	P	P	P	P	P	
Macrocystis pyrifera	Giant kelp, drift	P	P	P	P	P	P
Cnidaria	**Hydroids, Sea Anemones, Sea Pens, Corals,**						
Acanthoptilum sp.	Sea Pen			A	A	A	A
Adelogorgia phyllostera	Orange gorgonian						P
Anthopleura artemsia?	Moonglow anemone				P		
Cerianthidae, unident.	Cerianthid anemone			C	P	A	C
Metridium farcimen (=giganteum)	White-plumed anemone			P		P	P
Pachycerianthus sp.	Tube anemone			C	P	A	C
Ptilosarcus gurneyi	Orange or fleshy sea pen			A			
Scytalium sp.	Sea pen			P	P	P	P
Stomphia coccinea	Swimming anemone		C	A			
Stylatula elongata	White sea pen	A	C	A	A	A	A
Stylatula sp.	Sea pen	A	C	A	A	A	A
Urticina columbiana	Sand-rose anemone		C				
Urticina piscivora	White-spotted rose anemone Fish-eating anemone		C				
Urticina sp.	Anemone, unident.		P	C	A	A	A
Virgularia californica	Sea pen		P	A	P	A	A
Virgularia sp	Sea pen		P	A	A	A	A
Virgularidae unident.	Sea pen		P	A	P	A	A
Annelida	**Segmented Worms**						
Amphinomidae	Free living Polychaete						A
Chloeia pinnata?	Free living polychaete						A
Diopatra ornata	Ornate tube worm	A	P	P			
	Tube Worm, unident.	P	P	C	A	A	A
Mollusca	**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**						
Bivalve Mollusk	Clam like bivalve			P			
Gastropoda	Marine snail		P	C	P		
Loligo sp.	squid	P	P	P	P	P	P
Octopus rubescens	Octopus	C		A	C	C	C
Pleurobranchea californica	Sea slug			P	P	C	C

Scientific Name	Common Name	Cable Route Segment					
		A&B	C	D	E	F (<340ft)	F (> 340ft)
Arthropoda	**Shrimp, Crabs, Isopods**						
Cancer gracilis	Slender crab	A		C	P	P	P
Cancer sp	Crab	A	P	C	C	C	C
Hinnites giganteus	Rock scallop			P			
Loxorhynchus crispatus	Masking crab		P				
Paguristes sp.	Hermit crab			P			
Pandalis jordani?	Pacific ocean shrimp			C	P	P	P
Pandalid shrimp	Shrimp			C	P	P	P
Echinodermata	**Sea Stars, Brittle Stars**						
Amphiodia urtica	Brittle star				A	A	A
Amphiodia sp.	Brittle star				A	A	A
Amphipholis sp.	Brittle star				A	A	A
Asterina miniata	Bat star	P	P	A	P	P	P
Astropecten verrilli and/or A. *armatus*	Spiny sand star			P			
Dedraster ecentricus	Sand dollar			P			
Dermasterias imbricata	Leather star			P			
Ecinoderm, juvenile unident.	Juvenile sea star		P	P			
Mediaster aequalis	Red sea star	C	C	P	P		
Ophionereis sp.	Brittle star			A			
Ophiura sp.	Brittle star		P	P	P	P	P
Ophiuroids	Brittle star		P	A	A	A	A
Parastichopus sp.	Sea cucumber					P	
Petalaster (luidia) foliolata	Leafy flat star	P	P	A	C	P	P
Pisaster brevispinus	Pink sea star		A	A	P		
Pisaster sp.	Sea star		C	A			
Pisaster giganteus	Giant-spined sea star		P				
Pycnopodia helianthoides	Sunflower star		P			P	
Rathbunaster californica	Multi-armed sea star			A	C	C	C
Solaster dawsonii	Morning sun star			P	P		
Total number of taxa observed		**14**	**28**	**43**	**34**	**32**	**31**

Table 5: Fish taxa observed in association with soft-sediment habitat areas along the six Survey Segments of the AT&T AAG S-5 fiber optic cable route offshore Morro Bay, California.

Scientific Name	Common Name	Cable Route Segment					
		A&B	C	D	E	F (<340ft)	F (>340ft)
Agonidae unident.	Poacher			C	C	P	
Aulorhynchus flavidus	Tubesnout	C					P
Cephaloscyllium ventriosum	Swell shark		P				
Chilara taylori	Spotted cusk-eel	P	C	A	A	A	C
Chilara sp	Cusk-eel	P	P	A	A	A	A
Citharichthys sordidus	Pacific sanddab			A	C	C	C
Citharichthys spp	Sanddab			A	C	C	C
Cottidae unident.	Sculpin, cabezon			A	C	P	P
Engraulis mordax	Anchovy	A			C	A	A
Enophrys taurina	Bull sculpin			P			
Eptatretus stouti	Pacific hagfish			P	P	C	C
Genyonemus lineatus	White croaker			P			
Hydrolagus colliei	Spotted ratfish				P		
Lycodes sp.	Eelpout			A	A	A	A
Microstomus pacificus	Dover sole			C	C	C	
Ophiodon elongatus	Lingcod			P			
Paralichthys californicus	California halibut			C	C	C	P
Pleuronectes vetulas	English sole			C	C	C	
Pleuronectidae unident.	Sole			C	C	C	P
Raja binoculata	Big skate			P			
Raja rhina	Longnose skate					P	
Raja sp.	Skate			P	P	P	
Sebastes rosaeeus	Rosy rockfish		P	P	P		
Sebastes serrinoides	Olive rockfish			P			
Sebastes spp. (juveniles)	Rockfish (juveniles)		C	C	C	A	P
Sebastes spp. (adult)	Rockfish (adult)		C	C	C	C	P
Paralabrax clathratus	Kelp bass		P	P			
Squatina californica	Pacific angel shark			P			
Symphurus atricauda	California tonguefish			A	C	C	
Torpedo californica	Pacific electric ray			P			
Zalembius rosaceus	Pink surfperch			C	C	C	
Zanioleis latipinnis	Longspine combfish					P	
Zapteryx exasperata	Banded guitarfish			P			
	Unidentified Fish	A	C	A	A	A	C
	Unidentified Flatfish	A	C	A	A	A	C
Total number of taxa observed		**6**	**9**	**29**	**22**	**22**	**15**

Twenty-nine fish taxa were observed in video records from the soft-bottom areas of Survey Segment D (Table 5). Observed fish species included assorted flatfish including sanddabs (*Citharichtys sp*.), California halibut (*Paralichthys californicus),* Dover sole (*Microstomus pacificus) and English sole (Pleuronectes vetulas),* tonguefish (*Symphurus atricauda)* a banded guitarfish (*Zapteryx exasperata), Pacific electric ray (Torpedo californica*), a Pacific angel shark (*Squatina californica),* (juvenile rockfish (Sebastes sp.), eelpouts (*Lycodes* sp.), cuskeels (*Chilara* sp), poachers (Algonidae), sculpins (Cotidae) and hagfish (*Eptatretus stouti)*. The dominant and most frequently observed fish taxa were the assorted flatfish, especially pacific sanddabs (*C. sordidus*), cusk-eels, poachers and rockfish.

Associated invertebrate and vertebrate biota observed inhabiting the soft-bottom areas of this Survey Segment appeared to be the most diverse as a result of the increased diversity in bottom habitat and more stable oceanographic conditions. The biota inhabiting the realigned cable route segments that transit the soft-bottom habitat in this Survey Segment are expected to be the same as those observed in the ROV Biological Survey because of similar sediment composition, water depths, and oceanographic conditions.

4.1.4 Segment E (76.2-85.3m)

This segment of the initial cable route consisted predominantly of highly bioturbated fine sand and silt sediments (Figures 3, 10, and 11). One very small area of low-relief hard-bottom habitat was observed within the 100 m wide cable right-of-way, but not at the centerline. This feature represents the northernmost extension of a much larger area of high-relief hard-bottom habitat located just south of the proposed cable route (Figures 2, 3d and 3e). Both hard-bottom areas are located in approximately 83.5m (274-ft.) of water.

Thirty-four algal and invertebrate taxa were observed in video records from soft-bottom areas along the initial proposed cable route through Survey Segment E (Table 4). The epibenthic biota associated with the soft-sediment habitat consisted of several species of sea pens including *Stylatula, sp, Virgularia californica, Virgularia agassizii, Scytallum* sp,, and *Scytallopsis* sp., brittle stars including *Amphiophodia urtica*, *Amphiopholis* sp,, *Amhiodia* sp., *Ophionereis sp, and Ophiura* sp., octopus (*Octopus rubescens*), the California sea slug (*Pleurobranchia californica*), several species of anemones including *Urticina sp*., and *Pachycerianthus sp*., the sea stars *Asterina (Luidia) foliolata, Rathbunaster californica*,, and *Astropecten sp*. The dominant invertebrate taxa were the sea pens Stylatula sp., V. californica, and V. agassizi, the brittle star *A. urtica*, the cerianthid anemone (*Pachycerianthus* sp.), cancer crabs, especially *C. gracilis*, and octopus.

Twenty-two fish taxa were observed in video records inhabiting the soft-bottom areas along the initial proposed cable route of Survey Segment E (Table 5). The observed bottom dwelling fish species included assorted flatfish including sanddabs (*Citharichtys sp*.) and sole (Pleuronectidae), poachers (Cottidae), sculpin (Cottidae), skates (Raja sp), juvenile rockfish (Sebastes sp.). eelpouts (*Lycodes* sp.), cuskeels (*Chilara* sp), and sculpins. The dominant and most frequently observed fish taxa were cuskeels, flatfish, and juvenile rockfish.

In the final proposed cable route through Survey Segment E, two route realignments were made. One routes the cable back to the initial surveyed route, following the realignment to the southwest at the western-most end of Survey Segment D (Figure 3d), to avoid extensive hard-bottom habitat. The second realignment is located just north of the high-relief feature located on the southern edge of the cable right-of-way in approximately 85-m or water depth. This realignment was made to put additional distance between this hard-bottom habitat and the cable route centerline and remove the feature from the 100-m wide cable right-of-way corridor. Both of these route realignments transit the same habitat types

as the cable route originally surveyed and are expected to contain the same soft-bottom invertebrate and vertebrate biota as observed during the ROV Biological Survey in this Survey Segment.

4.1.5 Segment F (85.3-153m)

This Survey Segment of the initial proposed cable route consisted of two slightly differing soft-bottom habitats that varied physically based upon the extent of bioturbation (Figures 3e, 3f). The shallower portion was heavily bioturbated, like Survey Segment E, and the associated biological community was similar. The deeper portion lacked this heavy bioturbation. The final proposed cable route shifts slightly to the north at the western edge of this Survey Segment, in order to achieve deeper cable burial depth (Figure 3f). Biota observed in this deeper-water portion of the Survey Segment, although as similarly diverse in species as the shallower portion, the observed taxa were generally less abundant (Table 4 and 5). The one exception was a free-living polychaete. Biota inhabiting the realigned portion of the cable route through this Survey Segment are expected to remain the same as observed in the ROV Biological Survey.

The shallower portion of the two observed soft-sediment habitats observed in this Survey Segment transited between 85.3m and 103.7m (280-340ft) of water. Thirty-two algal and invertebrate taxa were observed in video records from this shallower section of Survey Segment F (Table 4). The biological community observed inhabiting this segment was similar to those observed and reported for Survey Segment E. Figures 11 and 12 illustrate the habitat and some of the associated biota observed in this Survey Segment. The deeper portion transited between depths of 103.7–153m (340-500ft) where the current survey ceased and contained 31 algal and invertebrate taxa observed in video records (Table 4). The biological community observed along this deeper portion of the cable route consisted of sea pens including *Stylatula, sp, Virgularia californica, Virgularia agassizii, and Scytallum* sp., brittle stars including *Amphiophodia urtica*, *Amphiopholis* sp,, *Amhiodia* sp., *Ophionereis sp, and Ophiura* sp., squid (*Loligo* sp), octopus (*Octopus rubescens*) the California sea slug (*Pleurobranchia californica*), several species of anemones including *Urticina sp.,* and *Pachycerianthus sp*., the sea stars *Rathbunaster californica*, *P. foliolata,* the sea cucumber *Parastichopus sp*., occasional orange gorgonians (*Adelogogia phyllostera*), and a free living polychaete fire worm (Amphinomidae). The dominant invertebrate taxa were the fire worms, brittle stars, and sea pens. The fire worms were observed in abundances approaching thousands per square meter and the other species were observed in much lower abundances than observed in Survey Segment E and the shallower portion of Survey Segment F.

Twenty-two fish taxa were observed in video records from the shallower soft-bottom areas of Survey Segment F and 15 fish taxa were observed the deeper section of Survey Segment F (Table 5). Observed fish species included pink surfperch (*Zalembius rosaceus*), poachers (Algonidae), hagfish (*Eptatretus stouti*), rockfish (Sebastes spp.), both juveniles and adults, anchovies (*E. Mordax*), tonguefish (*Symphurus atricauda)*, skate including big eye skate (*Raja binoculata),* longnose skate *(Raja binoculata)* and several unidentified skates, flatfish including sanddabs (Citharichtys sp.), sole (Pleuronectidae), and unidentified flatfish, eelpouts (*Lycodes* sp.), and cuskeels (*Chilara* sp), The dominant fish taxa were cuskeels, eelpouts, tonguefish, hagfish and anchovies in the water column. All fish species were observed in lower abundance than in Survey Segment E and the shallower portion of F.

4.2 Hard-bottom habitat

4.2.1 Segment C (27.40-32.0m)

The hard-bottom habitat observed along the initial proposed cable route in this Survey Segment was a mix of low (< 1m) and high-relief (> 1m) continuous rock shelves (Figures 3 b. 3c, 4, 13 and 14). Based

upon quantitative analysis of photos, the predominant assemblage covering rock substratum in this area (43% cover) was a turf of Komokoiacea foraminiferans and hydroids. Substrata in photographs also included 15%, 8.5%, 8%, and 7% coverage by gravel, sediment on rock, sediment, and bare rock, respectively (Table 6). Based upon percent cover data from analysis of photographs, the five most abundant taxa in the hard-bottom habitat of this transect were the unknown orange encrusting bryozoan (5.3%), encrusting coralline algae over rock (3.3%), unknown tan globular sponge (2.0%), the brown cup coral *Paracyathus stearnsi* (1.7%), and the purple-ringed sea star *Pisaster giganteus* (1.2%). Eighteen taxa were identified in the photos of hard-bottom habitat in Survey Segment C.

Visual observations of video records from initial proposed cable route in Survey Segment C revealed additional large taxa inhabiting the hard-bottom habitat than were contacted by points in the photo analysis. Also observed in Survey Segment C were the red alga *Rhodymenia* sp., a saucer-shaped sponge, a foliose white sponge, the anemones *Urticina columbiana*, *U. piscivora*, *Metridium* sp., and *Stomphia coccinea* and the sea stars *Mediaster aequalis* and *Pisaster brevispinus*.

As discussed in Section 4.1.2, the final proposed cable route through this Survey Segment was shifted to the east to avoid all of the low- and high-relief hard-bottom area mapped and observed (Figures 3b, 3c). The new cable route might encounter some low-relief hard-bottom or mixed cobble and sand habitat, especially at the south end of the Survey Segment, as it transits eastward to avoid extensive hard-bottom habitat (Figure 3b and 3c). If encountered, the marine biota in this hard-bottom area is expected to be the same as that characterized in similar hard-bottom and mixed-bottom habitats described for Survey Segments C and D.

4.2.2 Segment D (32.0-76.2m)

The hard-bottom habitat observed along the initial proposed cable route through this Survey Segment consisted of exposed low-relief (<1m) exposed shelf rock, small boulders and cobbles and some high-relief (>1 m) near the eastern end of the segment (Figures 3 c and d, 15, 16 and 17). The mean percent cover of primary substrates were 28% turf of Komokoiacea foraminiferans and hydroids, 21.4% sediment, 13.8% gravel, 12.7% sediment on rock, and 5% bare rock (Table 6). Based upon percent cover data from analysis of photographs, the five most abundant taxa in the hard-bottom habitat of this transect were *Cellaria sp*. (2.1%), an unknown orange encrusting bryozoan (1.8%), *Dermasterias imbricata* (1.75%), *Paracyathus stearnsi* (1.5%), and an unknown tan globular sponge (1.1%). Twenty-eight taxa were identified in the photos of hard-bottom habitat from Survey Segment D.

Visual observations of video records from the initial proposed cable route of Survey Segment D also revealed additional taxa in hard-bottom habitat than were contacted by points in the photo analysis. Also observed in Survey Segment D were a large erect saucer-shaped sponge, white encrusting, white foliose, and white erect sponges, a yellow puff ball sponge, a yellow encrusting sponge, an orange encrusting sponge, an orange puff ball sponge, an orange foliose sponge, the anemones *Metridium* sp., and *Stomphia* coccinea, unidentified cerianthid anemones, the soft coral *Stylaster californicus (=Allopora californica)*, the gorgonians *Lophogorgia chiliensis* and *Adelogorgia phyllostera*, the crab *Cancer* sp., the sea stars *Mediaster aequalis*, *Orthasterias koehleri*, the cookie cutter sea star, *Ceramaster patagonicus* and *Henricia* sp., crinoids (probably *Florometra serratissima*), the ascidian *Ascidia paratropa*, the cabezon, *Scorpaenichthys marmoratus*, the olive rockfish, *Sebastes serranoides*, and the rosy rockfish, *Sebastes rosaceus* and juvenile rockfishes.

As discussed in Section 4.1.3, the final proposed cable route through Survey Segment D was realigned to avoid hard-bottom habitat at the western end of the Survey Segment (Figure 3d). The final cable route drops slightly south between 59-m and 68-m water depth to avoid some low-relief rock outcropping

centered at the 65-m contour. Then, at the 71-m depth contour, the cable route is realigned southwest to avoid the high- and low-relief hard-bottom rock outcropping located at the west end of the initial proposed cable route through Survey Segment D (Figure 3d). The final proposed cable route through this Survey Segment is expected to transit predominantly soft-bottom habitat and an estimated 57-m of low-relief hard-bottom habitat, as compared to 77-m of mixed-bottom habitat, 139-m of low-relief hard-bottom habitat, and 50-m of high-relief hard-bottom habitat observed in the ROV Biological Survey. The biota inhabiting the hard-bottom habitat along the final proposed cable route is expected to be similar to that in the low-relief hard-bottom habitat observed in the ROV Biological Survey.

4.2.3 Segment E (76.2-85.3m)

Survey Segment E is the deepest segment of the ROV survey and proposed cable route with any exposed hard-bottom, which was composed predominantly of high-relief (>1 m) stepped shelf-rock ridges (Figures 16 and 17). This area of hard-bottom habitat represents the northern tip of a larger area of exposed shelf rock that extends to the southeast (Figure 3e). The observed and surveyed feature does not occur along the proposed fiber optic cable route centerline, but does occur within the 100-m wide right-of-way corridor, beginning about 25m south of the centerline and continuing in a southeast direction from the initial proposed cable route. The final proposed cable route (Figure 3e) has been slightly realigned to the north to avoid this high-relief hard-bottom rock outcropping and to have the entire 100-m wide cable right-of–way avoid the high-relief hard-bottom feature.

The mean percent cover of primary substrates in this hard-bottom area were 32% turf of Komokoiacea foraminiferans and hydroids, 11% sediment on rock, 2% bare rock and 1.3% sediment (Table 6). Based upon percent cover data from analysis of photographs, the five most abundant taxa in the hard-bottom habitat of this transect were *Metridium farcimen (=giganteum)* (20.5%), *Lophogorgia chiliensis* (4.9%), unknown orange encrusting bryozoan (1.5%), unknown yellow lumpy sponge (1.17%), and *Pisaster giganteus* (1.14%). Sixteen taxa were identified in the photos of hard-bottom habitat from Survey Segment E.

Visual observations of video records from Survey Segment E also revealed additional taxa in hard-bottom habitat than were contacted by points in the photo analysis. Also observed in Survey Segment C were a red encrusting sponge, the orange gorgonian *Adelogorgia phyllostera*, the brown cup coral, *Paracyathus stearnsi*, the California hydrocoral *Stylaster californicus (=Allopora californica)*, the cookie cutter sea star, *Ceramaster patagonicus*, the olive rockfish, *Sebastes serranoides*, and the rosy rockfish, *Sebastes rosaceus*, and the brown rockfish, *Sebastes auriculatus* and juvenile rockfishes.

4.2.4 Effects of Location (Survey Segment) and Habitat Relief

Very few taxa or community parameters of the various hard-bottom substrate surveyed differed significantly between Survey Segments or due to habitat relief (Table 7). Only *Cellaria* sp., encrusting coralline algae, *Metridium farcimen (=giganteum)*, orange encrusting bryozoan, total algal and invertebrate cover and Shannon-Weaver diversity differed significantly among Survey Segments. Survey Segment C had the highest percent cover for encrusting coralline algae and the orange encrusting bryozoan, whereas Survey Segment D had the highest percent cover of *Cellaria* sp. and Survey Segment E had the highest percent cover of *M. giganteum*, total algal and invertebrate percent cover and Shannon-Weaver diversity. Only the ascidian *Cystodytes* sp. and Shannon-Weaver diversity differed significantly between habitat relief categories, with high-relief habitat having the highest mean for each.

In reviewing the video records of the had-bottom habitats within each Survey Segment, a few minor differences were observed. Crinoids were only observed attached to hard substrate in Survey Segment D

Table 6: Mean and standard deviation for percent cover of hard-bottom organisms, Shannon-Weaver diversity and substratum type based on point-contact analysis of photographs. The number of photographs analyzed for each segment is also indicated.

Phylum	Scientific Name	Common Name	Mean % Cover by segment			Standard Deviation % Cover by segment		
			C	D	E	C	D	E
Plantae		**Coralline algae**						
		Encrusting Coralline Algae	3.30	0.0	0.0	5.37	0.0	0.0
Porifera		**Sponges**						
		tan globose Sponge,	2.0	1.07	0.52	3.42	2.75	1.17
		Yellow lumpy Sponge,	0.0	0.0	1.17	0.0	0.0	3.05
	Tethya aurantia	Orange puff ball sponge	0.0	0.96	0.0	0.0	3.44	0.0
Cnidaria		**Hydroids, sea anemones, Sea Pens, Corals,**						
	Balanophyllia elegans	Orange cup coral	0.36	0.38	0.28	1.06	1.13	0.91
	Corynactis californica	Strawberry anemone	0.88	0.0	0.0	3.72	0.0	0.0
	Lophogorgia chiliensis	Red gorgonian (sea whip)	0.0	0.84	4.88	0.0	2.57	8.53
	Metridium farcimen (=giganteum)	White-plumed anemone	0.0	0.33	20.51	0.0	1.43	9.77
	Paracyathus stearnsi	Brown cup coral	1.70	1.51	0.0	3.69	2.99	0.0
	Urticina lofotensis	Beaded anemone	0.18	0.0	0.0	0.76	0.0	0.0
		Uknown plumed hydroid	0.19	0.57	0.28	0.79	1.80	0.94
		Uknown branched hydroid	0.0	0.18	0.0	0.0	0.76	0.0
Mollusca		**Gastropod**						
	Calliostoma annulatum	Purple-ring top snail	0.0	0.18	0.0	0.0	0.79	0.0
Polychaeta		**Segmented worm**						
		Unknown feathered tube worm	0.0	0.19	0.0	0.0	0.82	0.0
Ectoprocta		**Moss animals**						
		Bryozoa, orange branching	0.0	0.55	0.0	0.0	1.71	0.0
		Bryozoa, orange encrusting	5.27	1.80	1.46	6.48	2.10	3.44
		Bryozoa, pink encrusting	0.77	0.53	0.89	3.25	1.27	1.52
		Unknown Bryozoan	0.19	1.54	1.27	0.79	3.86	3.28
	Cellaria sp	Stick-figure bryozoan	0.0	2.12	0.0	0.0	4.52	0.0
Echinodermata		**Sea stars, brittle stars**						
	Asterina miniata	Bat star	0.19	0.19	0.0	0.81	0.82	0.0
	Dermasterias imbricata	Leather star	0.0	1.75	0.0	0.0	7.65	0.0

Phylum	Scientific Name	Common Name	Mean % Cover by segment			Standard Deviation % Cover by segment		
			C	D	E	C	D	E
	Mediaster aequalis	Red sea star	0.0	0.0	0.23	0.0	0.0	0.77
	Ophiocantha diplasia	Brittlestar	0.0	0.91	0.0	0.0	2.82	0.0
	Ophiocantha sp.	Brittlestar	0.0	0.35	0.0	0.0	1.05	0.0
	Ophiothrix spiculata	Brittlestar	0.0	0.36	0.0	0.0	1.07	0.0
	Orthasterias koehleri	Rainbow sea star	0.18	0.0	0.0	0.76	0.0	0.0
	Pisaster giganteus	Giant-spined star	1.17	0.0	1.14	4.96	0.0	3.77
Urochordata		**Tunicates**						
	Cystodytes sp.	Lobed tunicate	0.0	0.18	0.0	0.0	0.76	0.0
	Polyclinum planum	Elephant ear tunicate	0.0	0.19	0.0	0.0	0.82	0.0
Vertebrata		**Fishes**	0.0	0.0	0.23	0.0	0.0	0.77
	Paralabrax clathratus	Kelp Bass						
Substrata								
		Gravel	15.23	13.83	0.0	18.54	18.27	0.0
		Bare rock	7.12	5.21	2.35	14.10	11.42	7.78
		Sediment	8.03	21.36	1.35	12.54	18.37	2.66
		Sediment over rock	8.53	12.73	11.52	13.48	13.76	17.58
		Turf of Komokoiacea foraminiferans and hydroids	43.47	28.12	31.40	31.88	21.93	29.15
Other								
		Total algal and invertebrate cover	16.4	16.9	32.9	12.1	13.0	12.4
		Total number of taxa	5.17	6.26	4.73	1.76	1.97	1.27
		Shannon-Weaver Diversity Index	0.49	0.55	1.22	0.37	0.36	0.27
		Area of Photos (cm^2)	887	1273	3049	540	811	1622
		Number of Photos	18	19	11	-	-	-

D and although present, few *Metridium* anemones were observed occupying the upper ridges of high-relied features in Survey Segment C.

Due to differing amounts of hard-bottom habitat and varying conditions, different numbers of photographs were suitable for analysis from each hard-bottom area encountered (Table 7). Varying bottom conditions also resulted in different areas captured in each photograph, which resulted in slightly different mean photo areas from each segment. If a higher number of photographs had been suitable for analysis, probably more taxa would have exhibited significant differences between Survey Segments and categories of habitat relief.

4.3 Comparison of Biological Surveys

In May-June 1999, SAIC conducted an ROV survey of the seafloor habitat and associated biota offshore Morro Bay, California for the AT&T China-US S-7 and China-US E-1 fiber optic cables (SAIC, 1999). Both of these cables make landfall near the proposed AAG S-5 cable, but transit along slightly different routes through the nearshore region (Figures 1 and 3). The China-US S-7 cable follows a route closest and slightly northward of the AAG S-5 proposed route. Portions of Survey Segments A, B and C of the current survey were surveyed in the 1999 biological survey. The seafloor areas in Survey Segments D, E and F that were observed in the current survey were not surveyed in 1999, but comparable habitats at similar depths were.

Differences in survey goals and resulting analytical approaches between the two surveys make direct comparison of reported dominant taxa within the different habitat types difficult. For example, although both studies had the same goal to characterize seafloor habitat and associated marine biota, the SAIC study had as a primary focus of their endeavor "…to provide quantitative information on species of potential concern in high-relief areas". As a result, they only conducted quantitative analysis of epibenthic communities in high-relief hard-substrate areas. Low-relief hard-bottom and soft-sediment areas were analyzed solely for species presence/absence. However, as requested by California State Lands Commission staff, the current study focused on identifying the various soft-substrate and hard-bottom habitats along the surveyed cable route and the characterization of marine biota within each varying substrate. This resulted in the delineation of the various encountered seafloor habitats into multiple subcategories as well as gathering species abundance data resulting in more discreet information.

Despite these differences, some comparisons between the two studies can be made as follows.

- No observable changes in either marine habitat or associated biota within the nearshore Morro Bay region appear to have occurred over the past eight years based on observable species and similarities in reported habitat occurrence within comparable depth and route segments of the surveyed cable routes.

- Similar epibenthic plants, invertebrates, and fishes were observed in both surveys for both soft-substrate and hard-bottom habitats. Slight differences in species lists, primarily for fishes, could be due to the different times of the year (May-June vs. October) in which the two surveys were conducted, different cable routes crossing slightly different terrain, and different conditions affecting underwater visibility when the surveys were conducted.

- The soft-substrate habitats in the survey region were largely dominated by the same species of sea pens, sea stars, anemones, brittle stars, polychaetes (tube dwelling and free-living), octopuses, crabs, and fish taxa (flatfish) in both surveys.

- Although the 1999 survey did not report results by seafloor habitat types (other than soft or hard-bottom) or depth stratifications, as done in the current survey, some similar trends in soft-substrate taxa were reported. These include a gradual transition in sea pen species from *Stylatula elongata* and *Ptilosarchus gurneyi* in the shallower water depths of the cable route to *Virgularia* and *Acanthoptilum* species at the deeper depths.

- Both surveys observed the presence of free-living "fire-worm" polychaetes in the deeper segments of the project area. The previous survey reported their presence at water depths between 89.7-100m (294-328 ft) whereas the current survey observed them beginning slightly deeper at 104m (340 ft).

- Hard-bottom areas in both surveys were dominated by low-growing turf species, cup corals, seastars, encrusting sponges, and bryozoans. Both surveys reported similar occurrence of red algae in the shallower, photic depths, of each survey route and higher abundances of the large anemone, *Metridium farcimen (=giganteum)* in deeper waters.

- Both surveys observed the California hydrocoral, *Stylaster californicus (=Allopora californica),* infrequently in high-relief hard-bottom areas along the three surveyed cable routes.

- The current survey only observed the crinoid, *Florometra,* as part of the epibenthic community inhabiting hard-bottom areas in water depths between 32–76m (105–250ft) whereas the earlier survey reported it from all hard-bottom areas in deeper waters with higher numbers at depths greater than 100m (328 ft.). Since crinoids are a common component of all deeper water offshore hard-bottom habitats in central and southern California, this difference in observations is probably related to slightly different areas surveyed.

5.0 Observations and Conclusions

Based upon the analysis of the digital video and still images collected during the October 11-13, 2007 ROV survey of the nearshore portion of the AT&T AAG S-5 proposed fiber optic cable route offshore Morro Bay, California, and careful assessment of the geophysical seafloor map produced by multi-beam side-scan sonar, the following conclusions and general observations can be made:

- The epibenthic invertebrate, algal, and fish species observed along the proposed cable route are representative of hard-substrate and soft-substrate areas of central California and offshore Morro Bay (SAIC, 1999; Hyland, *et al*, 1994; SAIC and MEC, 1989; Thompson, 1993).

- Of the 14 kilometers of initial proposed cable route surveyed during the ROV Biological Survey, the predominant seafloor habitat is soft-substrate (85.0%) with 13.8% consisting of fine and medium sand, 18.0% coarser sand occurring in large waves and troughs, and 53.2% of finer sands and silts. Approximately 9.1 % of the survey route encounters mixed-bottom consisting of sand and exposed cobble,, 4.1% contains low-relief hard-bottom, and 2.1% contains high-relief hard-bottom. Most of the high-relief hard-bottom habitat occurs in Survey Segment C and most of the low-relief hard-bottom habitat occurs in Survey Segment D. One small high-relief feature is present in Survey Segment E, within the 100-m cable right-of-way, but ends 25m south of the centerline. Of the approximately 14.6 kilometers of the final proposed cable route, the predominant seafloor habitat type remains soft-substrate (85.6%) with 14.1% fine sands and silts, 51.3% finer sands and silts, and 20.2% coarser sands formed into large waves and troughs.

Table 7. Analysis of variance results for effects of location and habitat relief on the percent cover of hard-bottom organisms. Tukeys results indicate the categories between which significant differences exist. The category with the highest mean is to the left and that with the lowest mean in to the right.

	Model	Segment		Habitat Relief	
Taxon	r^2	*p*	**Tukey results**	*p*	**Tukeys results**
Asterina miniata	0.05	0.9654	D = C = E[1]	0.2422	L = H[2]
Balanophyllia elegans	0.01	0.9985	D = C = E	0.6846	L = H
Bryozoan, orange branching	0.08	0.3757	D = C = E	0.4278	L = H
Bryozoan, orange encrusting	0.16	0.0225	C = D, C > E, D = E	0.3193	H = R
Bryozoan, pink encrusting	0.02	0.6442	E = D = C	0.6129	L = H
Calliostoma annulatum	0.04	0.6225	D = C = E	0.5826	L = H
Cellaria sp.	0.17	0.0253	D = E, D > C, E = C	0.8115	L = H
Coralline algae, encrusting	0.30	0.0004	C > D = E	0.3549	L = H
Corynactis californica	0.08	0.2742	C = D = E	0.1655	H = L
Cystodytes sp.	0.12	0.1033	D = C = E	0.0496	H > R
Dermasterias imbricata	0.04	0.6225	D = C = E	0.5826	L = H
Hydroid, branched	0.04	0.6225	D = C = E	0.5826	L = H
Hydroid, plumed	0.02	0.6489	D = E = C	0.6057	H = R
Lophogorgia chiliensis	0.19	0.0541	E = D = C	0.5418	H = L
Mediaster aequalis	0.06	0.3761	E = C = D	1.0000	H = L
Metridium farcimen (= giganteum)	0.79	<0.0001	E > D = C	0.4621	H = L
Ophiocantha diplasia	0.08	0.4400	E = D = C	0.1232	H = L
Ophiothrix spiculata	0.09	0.3668	D = C = E	0.4221	L = H
Orthasterias koehleri	0.08	0.2742	C = D = E	0.1655	H = L
Paracyathus stearnsi	0.07	0.3768	D = C = E	0.8964	L = H
Pisaster giganteus	0.05	0.7888	E = C = D	0.2684	H = L
Polyclinum planum	0.04	0.6225	D = C = E	0.5826	L = H
Tethya aurantia	0.08	0.4178	D = C = E	0.4544	L = H
Tube worm, plumed	0.04	0.6225	D = C = E	0.5826	L = H
Urticina lofotensis	0.08	0.2742	C = D = E	0.1655	H = L
Sponge, yellow lumpy	0.12	0.1510	E = C = D	1.0000	H = L
Total algal and invertebrate cover	0.19	0.0440	E = D, E > C, D = C	0.9275	H = L
Total number of taxa	0.08	0.1985	D = C = E	0.8420	L = H
Shannon-Weaver Diversity Index	0.42	0.0039	E = D, E > C, D = C	0.0472	H > R

[1] = C, D and E refer to survey segments. [2] = L and H refer to low-relief and high-relief habitat, respectively.

- The amount of mixed-bottom and hard-bottom areas along the final proposed cable route are estimated to be reduced compared to those observed and mapped along the initial proposed cable route with mixed-bottom comprising 8.9%, low-relief hard-bottom 3.4%, and high-relief hard-bottom 0.07% of the cable route.

- The mapping of seafloor habitats observed during the ROV Biological Survey correlated well with and corroborated the geophysical seafloor mapping along the initial and final proposed cable routes.

- The most abundant marine invertebrate taxa observed associating with areas of soft-substrate habitat along the cable route included sea pens, brittle stars, anemones, tube worms, cancer crabs, octopus, sea stars, and a free living polychaete fire worm. Squid were also frequently observed in the water column. The most abundant fish species observed included cuskeels, eelpouts, flatfish, rockfish, poachers, sculpins, pink surfperch, hagfish, and anchovies in the water column.

- Marine taxa observed in hard-bottom habitats consisted mostly of sessile organisms that are restricted to solid substrata. Analysis of photographs using point-contact methods suggested the greatest percent of hard substrata was covered by anemones, bryozoans, sponges, seastars, and cup corals, in descending order of coverage. Also observed in video records from hard-bottom habitat were encrusting coralline algae, a red alga, assorted encrusting and erect sponges, the soft coral *Stylaster californicus (=Allopora californica)*, gorgonians, and several species of crabs. Observed dominant fish taxa included rockfish, cabezon, and greenling.

- Survey Segments A and B, which lie predominantly parallel to the coast in 21.3-30.5m (70-100ft) water depth, consist of soft-sediment habitat regularly exposed to high-energy waves and currents, as indicated by seafloor sediment composition and associated biota. The generally high turbidity noted during the survey and the scoured appearance of the exposed rocks at the southern end of Survey Segment C suggests this region of the fiber optic cable route undergoes frequent disturbance from wave energy. The epibenthic invertebrate community observed in this area was very low in diversity.

- The initial cable alignment through Survey Segment C consists primarily of low- and high-relief exposed shelf rock dipping in a southerly direction with individual features trending along a northeast to southwest axis. Much of the exposed low-relief rock in this area appears subject to frequent burial and exposure as exhibited by lower diversity and occurrence of attached organisms dominated by cup corals, large sponges and some species of anemones, which, upon reaching a certain size, are able to extend up through the sediment and survive during substrate burial. The realigned cable route through Survey Segment C transits predominantly soft-bottom habitat with a few possible patches of low-relief hard-bottom or mixed cobble and sand habitat at the southern end of Survey Segment C.

- Survey Segment D contains the greatest diversity of habitats along the cable route. It included low- and high-relief hard-bottom areas, mixed sand and cobble, coarse sand formed into large sand waves and troughs, and finer, more heavily bioturbated silt and fine sand. As a result, the associated biota observed along this segment of the proposed cable route was the most diverse, as indicated by the highest numbers of taxa observed in video records. The realigned cable route through this Survey Segment substantially reduces the amount of low- and high-relief hard-bottom habitat encountered along the proposed cable alignment.

- Clusters of multiple individuals of the sea star *Pisaster brevispinus* were frequently observed along the sand waves in the shallower portion of Survey Segment D, suggesting the presence of clams.

- The large standing sand waves observed along much of Survey Segment D are a major physical feature in the area. Observations of invertebrate taxa associated with these sand waves suggest they exert substantial influence on organism distributions.

- Survey Segment F and all but one small area of E consist of soft-bottom substrate composed of finer sands and silts. Between 32-104m (105-340ft) water depths these sediments were highly bioturbated.

- The presence of the free-living "fire worm" polychaete in Survey Segment F, in water depths greater than 104m (340ft), was associated with observable decreases in seafloor bioturbation, and reductions in the numbers of epibenthic invertebrate and fish taxa noted in video records.

- Quantitative data from analysis of photos revealed several differences in organism abundances associated with the relief of hard-bottom habitat and different survey segments, which correlated roughly with water depth. Most notably, encrusting coralline algae were found only in the shallower, more inshore regions of the survey area and coverage of the anemone *M. giganteum* and overall living cover were significantly greater in the deeper, more offshore regions of the survey area than in the shallower, more inshore areas. The Shannon-Weaver diversity index and the coverage of the compound ascidian *Cystodytes* sp. were greatest in photos from high-relief habitat.

- The high-relief hard-bottom feature observed in Survey Segment E is the northernmost extension of a much larger hard-bottom area to the south of the cable route. Although the feature was located within the cable right-of-way of the initial proposed cable route, the final proposed cable route has the centerline transiting slightly northward, to place this feature outside the 100-m wide cable right-of-way.

- The California coral *Stylaster californicus (=Allopora californica)* appeared infrequently in the high-relief areas in Survey Segments C and D, in water depths less then 80.5m (264ft). The individual specimens observed were small, non-branching, and attached to the sidewalls of the exposed rock features.

- Detrital specimens of surf grass (*Phyllospadix*), bull kelp (*Nereocystis*) and giant kelp (*Macrocystis*) were observed drifting along the seafloor throughout the survey route. However, no surf grass, bull kelp, or giant kelp beds were observed along the cable right-of-way.

- Comparing survey observations and data from the current survey with those previously collected in the area (SAIC, 1999) indicate that no substantial changes in either marine habitat or associated biota appear to have occurred over the past eight years within the nearshore Morro Bay region.

6.0 References & Citation

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7.0 Appendices

Appendix A: Digital Still & Video Files

Table A-1: AT&T Photo and Video Log Summary

Dive #	Survey Segment	Photo #'s	Habitat (HB/SB)	Date	Video Disk	Time	Navigation Fix's
1	E, F	1-49	SB	10/11/07	1,2,3	17:21-22:56	1-97
2	A	5665	SB	10/12/07	4	13:38-14:35	99-104
3	E	5666-5669	SB	"	4,5,6	16:03-16:22	105-109
	E	5670-5673	HB	"	6	16:29-16:44	110-112
	E, D	5674-5687	SB	"	7	16:53-18:48	113-139
	D	5688-5695	HB	"	7	18:59-19:35	140-148
	D	5696-5709	SB	"	7,8	19:37-21:09	149-170
	D	5710-5715	HB	"	8	21:17-21:24	171-175
	D	5716-5730	SB	"	8, 9	21:31-23;03	176-197
	D	5730-5732	HB	"	9	23:03-23:07	199-202
	D	5733-5751	SB	"	9	23:19-01:12	203-226
	D	5752-5773	HB	10/13/07	9	01:13-01:33	227-238
	D, C	5774-5784	SB	"	9,10	01:34-02:35	239-250
	C	5785-5807	HB	"	10	02:39-03:38	251-269
4	A, B	5808-5822	SB	10/13/07	11	05:19-07:01	270-291
	C	5823-5826	HB	"	11	07:04-07;09	292-294
	C	5827	SB	"	12	07:12	295
	C	5828-5860	HB	"	12	07:15-07:56	296-309
5	E	5861-5892	HB	10/13/07	13	09:12-09:36	310-323